Applied Grinding Wheel Performance Evaluation for Optical Fabrication*

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We are currently collaborating with the Center for Optics Manufacturing (Rochester, NY) to characterize and evaluate fine diamond grinding cup wheels for spherical generation of glass optics. To this end, we typically use a standardized method for wheel performance evaluation that focuses on workpiece quality. A new element of this work is the use of in-process acoustic emission (AE) measurements for correlating with performance. This paper includes recent results of our evaluation of several fine diamond grinding wheels and discusses how these techniques might be used to select grinding wheels.

Our standardized methodology for performance evaluation of grinding wheels includes in-process monitoring and experimental grindability measurements. Each wheel evaluation begins by truing and dressing the wheel using our standardized methods. Process monitoring includes grinding ratio measurements and the newly proposed acoustic emission sensing technique. As part of our evaluation, we also examine the diamond-bond matrix of the wheels for correlating with grinding performance. Lastly, as the most significant measure of grinding wheel performance, we recorded workpiece quality: surface roughness (Zygo New View), form (Zygo Mark IV), and subsurface damage (dimpling technique). These data are tabulated for comparison.

The grinding geometry employed in our current evaluation study is spherical generation where the grinding wheel and the workpiece each rotate on their respective spindles. The CNC machine tool is a stiff T-base platform on which both the grinding and workpiece spindles are mounted horizontally and position feedback is provided by distance measuring interferometers. The grinding zone is flooded with an aqueous based, temperature controlled grinding fluid. The workpiece material used in this study was BK7 glass.

We hope to apply in-process AE sensing as a tool for the continuous sensing of grinding quality that may reduce the need for labor-intensive off-line part measurements for process control. This work is part of an on-going evaluation of diamond grinding wheels relevant to the optics industry.

* This work was performed under the auspices of the U. S. Dept. of Energy by LLNL under contract No. W-7405-Eng-48.